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# SCIATIC NEURITIS:

PATHOLOGY AND TREATMENT.

BY

W. H. DODGE,

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# SCIATIC NEURITIS:

ITS

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## P R E F A C E .

THE satisfactory nature of the results which I have experienced in the treatment of Sciatic Neuritis by the methods suggested in this small volume, is the only apology which I have to offer for the contents of the following pages.

The general adoption of massage as a therapeutic agent is still a matter of the future, but a widening practical experience of its utility will occasion its more general application: personal experience in this direction, extending over a considerable period, has caused me to recognize its value.

If the perusal of these pages should lead others to enter upon an impartial investigation of its claims, they will have accomplished the object for which they have been written.

R. S.

BRISTOL,  
*June 23rd, 1893.*



## SCIATIC NEURITIS: ITS PATHOLOGY AND TREATMENT.

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CIATIC Neuritis, or inflammation of the sciatic nerve, with its attendant train of symptoms, motor-sensory, and trophic, is a form of disease which, owing to its very nature, as well as to the extent and wide-spread area of distribution of the great nerve tract which is involved, cannot but be surrounded with interest to the attentive observer of those phenomena, accompanied by varied and strange changes of function and structure, which inflammatory action occurring in nerve structures is apt to produce.

It would be entirely without the scope of this small volume to enter upon a comparative description of the important alterations, structural and functional, which are known to occur in the large nerve trunks of the

body when they have become the seat of inflammatory degeneration, the standard works abound with information full of interest to those who wish to pursue such a course of investigation; rather would the writer seek to confine himself to the task of elucidating some of the symptoms which present themselves, and of endeavouring to trace the connecting link between the pathological changes which take place, and those departures from the normal standard of functional activity and nutritional processes, which become so evident to the physician in those cases where the nerve trunk of the lower extremity has become the seat of inflammatory degeneration, a morbid condition generally designated "Sciatica," or "Sciatic Neuritis."

In their work on Physiology, Landois and Stirling lay down this axiom, "That the continuance of normal excitability in nerves depends upon the maintenance of normal nutrition in the nerves themselves, and a due supply of blood," and while this statement holds good with reference to the passage of motor impulses along any given nerve tract, it is equally true when applied to the conveyance of sensory impressions, that is to

say, not only does a disturbance of the balance of nutritional processes going on in nerves affect the passage of motor impulses along their fibres, but also, as the ultimate result of such nutritional disturbances, pathological conditions arise which materially interfere with the proper performance of function in the sensory fibres involved, so that we find in such cases impediments to the transmission of motor impulses, and also perversions of sensation which are of the utmost import; for instance, when such degenerative changes interfering with its proper nutrition take place in a mixed nerve consisting, like the sciatic, of motor, sensory, and trophic fibres, in the course of time, not only is motor excitability considerably altered, being sometimes increased, at others diminished, as the degeneration passes through its various phases, but there occurs also a modification in the functional activity of the sensory fibres, generally in the direction of an exalted sensibility, while in cases which are of long standing, trophic or nutritive changes of a most important character are found to have taken place, both in the nerve trunk itself, and in the muscular and other

structures to which its fibres are ultimately distributed.

Into the nature of such changes as these occurring in the sciatic nerve we purpose to enquire, endeavouring also to obtain some light upon the mode by which the return from the abnormal pathological conditions which arise, as we shall presently see, in the shape of structural alterations at the site of the inflammatory lesion, to a normal and healthy state may be brought about.

Neuritis of the sciatic nerve presents many variations, both as regards the seat of the inflammatory lesion and the intensity of its various symptoms, subjective and objective. It is met with in its acute and chronic form; as a rule, the chronic cases which occur in practice are those which were at the outset acute, although the writer has met with patients in whom the onset of the symptoms have been slow and insidious from the very commencement, and in which the various pathological conditions have assumed a chronic character without the previous occurrence of any marked acute stage, but divisions like these are mere arbitrary demarcations, due rather to variations of degree in the

severity of the symptoms, than to the extent of the inflammatory processes which are going on, because it is not uncommon to find that in the acute stages, where the symptoms are most aggravated, the pathological changes may not have extended beyond the nerve sheath (perineuritis), while, in the more chronic cases they have affected the deeper nerve structures, even as we shall presently see, penetrating to the axis-cylinders themselves (interstitial or parenchymatous neuritis), but it is well to remember that a neuritis does not of necessity primarily attack the nerve sheath and spread inwards; as a matter of fact, it may begin in any of the structures composing the nerve tract, the other portions being secondarily involved.

We shall now proceed to investigate

I.—*The manner in which nutrition in the great nerve trunks of the body is maintained in a state of equilibrium, so as to be compatible with the normal performance of function.*

A nerve tract may be briefly described as consisting of numerous fasciculi enclosed in an enveloping sheath and having a proper blood supply. These fasciculi are made up

of what are known as nerve elements, and it will be sufficient for our purpose to say that nerve elements consist of

*a.—NERVE FIBRES.*

*b.—NERVE CELLS.*

NERVE FIBRES differ widely from each other in structure, and present many variations in character, being found as simple primitive fibrils devoid of any investing membrane; or as axis-cylinders surrounded by a simple enveloping sheath (*non-medullated nerve fibres*). Medullated nerve fibres, on the other hand, are much more complex; consisting of a central axis-cylinder, which is a prolongation of one of the processes (axis-cylinder process) of a multipolar nerve cell; this axis-cylinder is surrounded by an investing structure, the white substance of schwann or myelin, while the whole is enclosed in an enveloping membrane the primitive sheath. These fibres are usually found in bundles, held together by a connective tissue sheath or epineurium, in which run blood vessels and lymphatics, each bundle of fibres being surrounded by an investing sheath or perineurium. As will be

gathered from the above brief description, the blood stream is brought into intimate relationship with the nerve fibres by means of the epineurium; this is necessary to remember, for, as we shall see later on, disturbance of the blood stream is an important factor in the causation of sciatic neuritis.

NERVE CELLS need only be referred to here, owing to the fact already stated that the axis-cylinders of the nerve fibres are formed by the prolongation of one of the processes of a multipolar nerve cell.

Nerve tracts composed as we have just seen of bundles of fibres, enclosed in a perineurium or enveloping sheath may, as regards their function, be motor, sensory, or trophic, either separate or combined.

The due performance of their several functions by nerve fibres and nerve cells, produces as in muscular and other tissues, a waste or casting off of effete material (katabolic or destructive metabolism), and at the same time, in order to compensate for this waste, there takes place a building up of the tissues by the addition of new structure, which process is known as anabolic or constructive metabolism, and moreover, in order to insure

a standard of tissue nutrition compatible with the performance of function, it is necessary that these two processes maintain a certain ratio to each other; when any disturbance of the equilibrium existing between them takes place, there results a corresponding disturbance of the normal nutritional processes going on in the structure so involved, and this ultimately results either in the temporary derangement, or entire abolition of functional activity in the affected nerve tract. It becomes necessary for us therefore to get some insight into the manner in which these two processes are maintained in their proper ratio, so that the resulting standard of metabolism may be consistent with the normal performance of function, before we can rightly appreciate the pathological processes which take place when the functional activity of the nerve is interfered with.

There are two sources, or channels, by means of which the normal metabolism, katabolic (destructive) and anabolic (constructive), is maintained in a condition of equilibrium. The first of these acts directly, and through the agency of the blood supply, which is in such intimate relationship with

the part, that the most minute and delicate structures in the nerve tract are laved by its stream, thus allowing for a free interchange of gases and promoting healthy tissue respiration; further, it is an undoubted fact that the circulation of the blood within the nerve has an important bearing upon its metabolic changes; this is evidenced by the fact that an interruption of the blood supply to any set of nerves produces an almost instantaneous decrease in their functional activity, which is again restored when the obstruction to its onward flow has been removed. If, for instance, the abdominal aorta of a rabbit be compressed for a few minutes, the hind limbs become paralysed very quickly, and if the animal attempts to crawl, locomotion can be performed by the fore limbs only, the hind legs being drawn helplessly along, evidently showing that the functional activity of nerve structures is dependent largely on their blood supply.

The second factor which affects the nutrition of nerves in this manner is due to the influence of certain nerve fibres, whose special function is to preside over the nutrition of the tissues to which they are distributed.

These are known as trophic nerves and nerve fibres, and are in direct relationship with special centres, which control and govern their action, and which are known as trophic nerve centres.

In his work on *Diseases of the Nervous System*,\* Dr. Gowers states that the weight of evidence is opposed to the supposition that there are special nerve fibres, whose function it is to preside over the nutrition of the part to which they are distributed, but while there are facts of great weight which may tend to prove that trophic fibres do not exist, there are also facts equally weighty on the other side. The experiments of Waller, and the law based upon those experiments, which is known as the Wallerian law of degeneration of nerves, are in themselves (independent of a mass of other testimony which has been collected) most conclusive, that in the case of the spinal nerves, at any rate, there exist fibres which have a special influence upon the nutritive process going on in the nerve structures, and he also proves that these trophic fibres are in connection with controlling centres, those for the anterior nerve roots

being located in the multipolar cells of the anterior horn of the grey matter, while those for the posterior roots are in the ganglia placed thereon.

Bearing in mind that in the sciatic nerve we find the blood-stream carried into the most intimate relationships with the minute nerve structures, and also that in it we have existing trophic nerve fibres,—both conditions being of vital importance in the matter of nutrition,—it becomes a comparatively simple matter to understand how easily the balance of metabolism may be disturbed, and the normal nutrition of the nerve seriously interfered with, leading to the partial or even total suspension of its functional activity. It is only necessary to suppose a disturbance of the blood-stream which supplies the fibres of the sciatic, both motor, sensory, and trophic, with a large amount of their pabulum, to understand the inevitable consequence, viz., that a derangement of functional activity will take place in the trophic fibres, and thus set into active operation the two factors working in concert with each other, whose combined action is sufficient to seriously interfere with the nutrition of the whole of the structures

composing the nerve tract. That the primary cause of a neuritis, namely, a disturbance of the nutritional processes in the nerve fibres, is what actually takes place, we shall see later on, when we come to consider the question of the pathology of this disease.

Granting, therefore, the existence of trophic nerve fibres, and that these are presided over by special governing centres, and also (as Waller's experiments have shown) that these trophic centres and fibres have a direct action upon the nutritional processes going on within the nerves in which they exist, it becomes evident that the operation of any cause, or series of causes, which interferes in the first place with the normal conditions of blood supply to the nerve fibres, and in the second place with the due performance of their function by the trophic fibres in the nerve tract, will so affect the nutrition and respiration of tissues in the nerve itself, that ere long serious interference with its functional activity must take place, the effete materials which are the outcome of the process of katabolic metabolism cease to be removed, and the constructive material ceases to be conveyed to the part; consequently nutrition is at a

stand-still, and impairment of function results.

*II.—The nature of the pathological changes occurring in neuritis, and the manner in which they induce departures from the normal standard of nerve nutrition.*

Abnormal conditions of nerve excitability, coupled with a disturbance of the balance of metabolic activity, both in the nerve itself and in the parts to which it is ultimately distributed, together with an alteration in the conveyance of sensory impressions, and pain, may be tabulated briefly as amongst the most prominent evidences of sciatic neuritis. What we desire now, is to enquire into the nature of the pathological conditions which are the precursors of these important alterations in the nutrition and functional activity of the part involved, and in order to investigate their nature more fully, it will be necessary to notice the sequence in which they occur, as well as the character of certain important structural changes which take place at the seat of the inflammatory lesion. I cannot do better here than quote Dr. Gower's own words upon the subject. Writing on the pathology

of neuritis, he says,\* "In acute inflammation, the affected part of the nerve is red and swollen, the redness depends upon distended vessels which may be visible on the surface; the swelling is due to oedema, or to a sero-fibrinous exudation, sometimes jelly-like in aspect; the microscope shows leucocyte-like corpuscles *surrounding the vessel infiltrating the sheath, and accumulating between it and the nerve*,† these changes may be limited to the sheath (in what is called perineuritis), or may extend into the substance of the nerve (in interstitial neuritis); in the latter case the lymphoid corpuscles infiltrate the septa, and may even be seen in the substance of the fasciculi between the nerve fibres. The extent to which the nerve fibres suffer varies much; they usually present little change when the inflammation is limited to the sheath, unless the nerve lies in a bony canal, or in rigid fibrous tissue, within which the sheath cannot expand; when the inflammation is interstitial the fibres suffer more readily, although not invariably; on the other hand, they are some-

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\* "Diseases of the Nervous System," Vol. I., page 65, *et seq.*

† The italics are my own.

times found much altered where the connective tissue elements are little affected ; in this case the inflammation is parenchymatous, and begins in the nerve fibres, the interstitial tissue being secondarily involved or unaffected, the changes in the fibres are almost the same as in degeneration. . . . . The myelin of the white substance first breaks up into segments, more or less elongated, often with smaller globules of myelin between or beside them. The masses are cloudy, finely granular in aspect. *The axis-cylinders are interrupted where the myelin is divided.*"\*

We have here a most graphic description of the pathological conditions which arise in the course of a neuritis, from which it appears that a lesion, beginning as a simple hyperæmia of the nerve sheath, may, by a succession of pathological processes, lead on to serious structural derangement of the inflamed part, terminating, as we have seen, in a breaking up into segments of the axis-cylinders themselves. Taking our stand upon this vantage ground, and observing from it the many important alterations which take place in the limb affected with sciatic neuritis, it becomes

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\* The italics are again my own.

an extremely interesting study to trace out the connecting link existing between those changes in structure which the pathologist reveals as taking place at the site of the lesion, and the marked functional disturbances which are evident to the sense of the observer ; these functional changes are varied both in nature and degree, and depend (1,) Upon the extent of the inflammatory lesions ; (2,) Upon the structures involved ; and (3,) Upon the length of time during which the causes producing them have been in operation.

It is very evident to careful observers of the pathological changes in neuritis of the sciatic nerve, that we have here to deal not only with a disturbance of the equilibrium of the normal interchange of material accompanying the destructive and constructive metabolism, which under ordinary circumstances takes place within the nerve ; but also with important structural derangements resulting from the pressure set up by the lymphoid corpuscles which become deposited in and around the nerve structures.

We have already seen that anything which interferes with the normal blood supply of a nerve alters its functional activity, and we

should look for such an alteration of function as the first symptom indicating the occurrence of sciatic neuritis. The effects produced by interference with the normal blood supply to a nerve are two-fold, the first visible effect being that of paralysis, 'as we saw on page 13, which, however, is preceded by a stage during which the electrical excitability of the nerve is increased, and which may be of longer or shorter duration ; this earliest derangement of function is unfortunately not easily investigated in the class of cases which we are now considering, chiefly owing to the fact that they do not come under the observation of the physician until the initial symptom of exalted excitability has been replaced by those indicative of more advanced pathological processes, the occurrence of pain being generally the first thing which compels the sufferer to seek relief, and this symptom does not present itself in an acute form until the causes producing the inflammatory processes have been some time in operation, and the initial excitability has passed off. Pain, however, is the dominant symptom of sciatic neuritis, and, according to the exact situation of the inflammatory lesion, may be more or less acute, and may be

felt most either over the seat of the inflammation, or be referred to some point more or less distant from it. The connection existing between the symptom of pain and the changes taking place simultaneously in the diseased nerve is one of exceeding interest.

I have already mentioned, when referring to the pathology of this disease, the various pathological changes which arise and succeed one another, these may be briefly indicated in the following manner:—hyperæmia, followed by the pouring out between the sheath and the nerve, or else in the interstitial connective tissue, of an effusion of lymphoid corpuscles, followed in succession by the various degenerative changes already described, and as these are largely due to the presence of this lymphoid effusion, it will be well to investigate more closely the manner in which it exerts such an injurious influence. The first effect produced by such an effusion must necessarily be that of pressure exerted upon the most sensitive portions of the nerve structure, so that in reality we have present in this effused material a mechanical stimulus acting directly upon the sensitive nerve fibres; it is known as a matter of experience that the

effect of such a stimulus is two-fold, although this does not become apparent until the producing causes have been some time in operation. The first of these effects consists in *a derangement of molecular integrity*, and a disturbance of the metabolic processes going on within the nerve, leading ultimately to irritability of the nerve itself, and instability in the performance of its allotted function; while in the case of sensory fibres, one of the first effects is the production of pain.\* In addition to the phenomena here described, further degenerative changes occur, which are of the utmost importance from a pathological point of view, for not only does the mechanical stimulus produce derangements which may be looked upon as purely functional in character, but its continued presence produces effects which pass beyond the range of mere derangements of this description. The pathology of the disease shows that grave alterations of structure take place, not only affecting the white substance of Schwann, but invading the axis-cylinders of the nerve fibres, interfering with their powers of conductivity, or even breaking them into segments, and thus for the

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\* Landois and Stirling, page 533.

time being entirely abolishing, as far as they are concerned, the transmission of sensory or motor impulses. Careful investigations of the electrical reactions of the muscles in a limb affected with sciatic neuritis clearly proves that a breakdown has taken place somewhere in the great trunk line of communication between the muscle operated upon and the spinal centres. Thus it may be seen that a neuritis commencing as a simple hyperæmia of the nerve or nerve sheath, may pass from stage to stage until functional and structural derangements of the gravest kind ultimately result.

*III.—The nature of the reconstructive changes necessary to restore the diseased nerve structure to its state of normal functional activity.*

Before entering upon this aspect of the question, let us briefly review the various changes which we have been considering as taking place in sciatic neuritis, and which may be briefly tabulated as follows :—

- (1,) Hyperæmia affecting (a) the nerve sheath ; (β) the interstitial connective tissue ; (γ) the parenchyma of the nerve.

(2,) As the result of circulatory disturbances, a suspension of the process of oxidation of tissue in the nerve itself.

(3,) Exudation of leucocytes (*α*) between the sheath and the nerve structure, or (*β*) in the interstitial connective tissue.

(4,) Disturbance of the functional activity of the trophic nerve fibres.

(5,) The exudation of leucocytes acting as a mechanical stimulus, exerting direct pressure upon the nerve fibres themselves, causing irritability of action and instability of function.

(6,) The continued action of the mechanical stimulus, ultimately causing breach of continuity of the axis-cylinders, with consequent arrest of the conveyance of sensory and motor impressions by the fibres so involved.

(7,) As the result of which, coupled with the arrest of function, or destruction of trophic nerve fibres, an unhinging of the balance of oxidation of muscular tissue with corresponding degenerative muscular changes.

Now when nerve function is impaired, and consequent muscular inactivity follows, metabolism of tissue is interfered with as the result of defective oxidation and respiration of tissue (Stretch Dowse). The importance of bringing

about as speedily as possible a normal standard of oxidation and respiration in the tissues, both muscular and nervous, at once becomes evident, in order to hasten the process of recovery.

There are three changes, or series of reconstructive processes, which are needful before we can expect to stay the structural degeneration which is in operation in these cases. The first of these, which I call reconstructive processes, is to restore a normal blood supply to the affected part, and this can only be accomplished by stimulation of the inhibitory nerve endings. Then we must produce a normal standard of oxidation and respiration of tissue in the structure involved; the manner in which this may be accomplished will be dealt with in the next section. The third reconstructive change consists in the removal of all abnormal mechanical pressure from within and around the nerve itself. Briefly stated, these are the most important variations in the pathological condition of the part which must be brought about before we can hope to see any progress towards the normal state in the diseased nerve tissues.

Lastly, I purpose to approach the most im-

portant of all questions in connection with the consideration of the grave changes of structure and function which occur in sciatic neuritis. It is quite evident, when we come to deal with the morbid condition produced by the intensity of the local inflammation, that the rational line of treatment is to endeavour to restore to the diseased nerve its normal functional activity by producing a series of reconstructive metamorphoses tending from the abnormal to the normal, and I now propose—

IV.—*To investigate the nature and action of the various therapeutic agents, by means of which the restoration of the diseased nerve to its normal condition may be achieved.*

Of all the means which we have at our disposal for the treatment of sciatic neuritis, none is more important than REST. In a lecture delivered in the Philadelphia Poly-clinic, Professor S. Weir-Mitchell, dealing with the subject of the treatment of this painful affection by means of dry cold and rest, speaks in the strongest terms of the imperative necessity of thorough and complete rest, both of the body and the affected

limb.\* It is especially, however, in old standing cases, in which degenerative changes have been going on for a considerable period, and in which, through defective nutrition, we find the parts involved in a very low state of vitality, that rest becomes of an importance which cannot be over-estimated, but is, I fear, often under-rated.

Nerves which for a considerable period have been badly nourished, and have not received their normal amount of pabulum from the blood stream, become easily fatigued ; this is only a reasonable deduction, for if their normal standard of food supply is diminished, metabolism cannot possibly be maintained in a state of equilibrium, and therefore it would be unreasonable to expect to find anything like a normal standard of functional activity ; impulses motor and sensory are for the time being delayed in transit, or totally interrupted, the path of the impulse current being, so far as some of the fibres are concerned, to all intents and purposes cut off from communication with the higher centres. Under such circumstances, any attempt at active movement by making demands for the passage of

\* "International Clinics," 1892, Vol. I., p. 277, *et seq.*

fresh impulses upon an already disabled nerve tract, must inevitably bring about a still further impairment of function, and interfere with the transmission of impulses by the enfeebled nerve fibres. Instead of permitting such a condition of things to occur by allowing injudicious exertion on the part of the patient, we should, by enjoining rest, absolute and complete, reduce the number of impressions which are conveyed by the disabled nerve fibres to a minimum, and thus help to bring about a normal standard of function and nutrition. In a case at present under the writer's care, this fact was remarkably illustrated. The patient had been a sufferer from sciatic neuritis for over twelve months. Not only was there great impairment of functional activity and excessive pain, but degenerative changes, both in nerve and muscle, were well established, and only too evident. Under treatment, however, a marked improvement took place in the course of a few weeks; pain was considerably relieved, functional activity was becoming restored, and locomotion could be performed with comparative ease, while the reactions to electrical stimuli were resuming a normal state. At this point

in the progress of the case, increased activity was undertaken by the patient instead of the rest he had been previously content with : the improvement which was so evident before immediately ceased, pain returned with marked severity, culminating in a short time in a most excruciating neuralgic attack, which lasted for several hours before relief could be obtained ; a return to the previous condition of rest restored the favourable progress as before, serving to emphasize the importance of rest as a factor in the relief of these most painful cases. Important and useful, however, as rest may be, it is not sufficient in itself, nor is it the only means we have at our command for bringing about the desired reconstructive changes. All writers upon this subject recognize the necessity of removing the exudation which takes place beneath the sheath, or within the nerve structure, before they can hope to see any return to a normal condition of things. With this object in view, many and various agents have from time to time been employed. From amongst the multitude of these may be mentioned counter irritation over the painful part by one fairly large or, better still, by a series of small fly blisters. The

method recommended by the late Sir Dominic Corrigan, of Dublin ; or counter irritation by the use of other vesicating substance. The writer has had cases under his care in which the application of Corrigan's button has been productive of satisfactory, though by no means lasting results. Treatment based upon such methods, while doing much to promote the reabsorption of a freshly poured out effusion, cannot by any means suffice to procure the absorption of the old standing lymphoid, and, in all probability, partly organized masses, which is so essential to bring about the reconstructive changes in these long-standing cases, in which extensive degeneration has taken place in the diseased fibres.

Of recent years nerve stretching has been resorted to as a method of treatment, based on the principle, doubtless, that tension of nerve fibres produces an alteration in their excitability, as well as on the ground that the nerve may be lifted out from amongst any masses of effused material which may have been poured out around it, as the result of inflammatory action. It is beyond dispute that extension or stretching of a nerve produces mechanical changes, either in the nerve itself,

or in its end organs, causing an alteration of excitability, and also that violent extension produces a temporary paralysis of the sensory fibres, thus giving the sufferer a short period of relief from pain ; and while nerve stretching is also of great value in permitting a nerve to be raised from out of a mass of effused material, it does not of itself fulfil all that is required to bring about the needed change. Another treatment of recent introduction is that of puncturing the nerve along its course, or over the most painful points, by means of long fine needles. Nor must we omit to mention the long list of drugs which have from time to time been employed in these cases. All these methods of treatment had one aim, viz., the removal of the exudation existing within and around the nerve, or beneath its sheath. In massage we have another method of treatment entirely different in character, which, while it possesses all the powers necessary for the promotion of the absorption of the effused material which produces such injurious effects upon the nerve fibres, possesses the additional advantages of being pleasant in its application, and of not leaving behind it any of those sequelæ which accompany such

treatment as counter irritation, or the application of the actual cautery ; while it is not intended to supersede the many medicinal agents which are of the greatest service in the treatment of sciatica, yet its adoption at once gives us a method of treatment which is painless, and at the same time more efficient than any other in promoting the reabsorption of the effused lymph, and in bringing about a return to the normal standard of metabolism in the diseased part. Referring to the use of massage in muscular fatigue, Zabludowski makes the following important statement : " He found that if a frog's muscle be systematically stimulated by maximum induction shocks until it has ceased to contract, massage or kneading rapidly restored its excitability, while simple rest had little effect." This is most valuable testimony to the power of the massage processes to restore functional activity to a fatigued muscle.

In his admirably written work, "*Massage and Electricity*," Stretch Dowse says, "Massage does what no other therapeutic agent can do, that is, brings into activity potential energy, restores the *normal* to the *abnormal*, maintains stable equilibrium of force. The results

of massage," he goes on to say, "are essentially vital, for by them undue stress, tension and pressure in the tissues are overcome, the natural antagonism between constrictor, dilator, and trophic nerves is established, the governing influence of the central nervous system is stimulated and relieved of inhibitory and fettering influences, endosmosis and exosmosis have free and fair play, katabolism and anabolism assume a normal level of correlative stability, and thus we ensure the natural functional activity of the processes of secretion, excretion, absorption and assimilation; in fact, healthy nutrition." I have ventured to quote Dr. Dowse's words very fully, because they give in a concise and graphic manner a vivid picture of the important tissue changes which the massage movements are capable of inducing. Nor is the picture a fanciful or imaginary one, as some might suppose; it is rather the summing up of the results of years of practical experience of the usefulness of massage as a therapeutic agent. Nor does Dr. Dowse stand alone in his conviction as to the importance and influence of massage as a method of treatment in those conditions in which respiration

of tissue is interfered with, for those who have witnessed its scientific application in suitable cases are free to confess that in it we possess one of the most potent agents for the production of those vital processes which are so essential to the amelioration of human suffering in many diseased states. It may be asked, What bearing has all this upon the case in point? Just this, we have already seen that the earliest change which we desire to bring about in sciatica is to promote the reabsorption of the effused lymph. Experience has proved that, this does not readily take place, especially in long-standing cases. When we come, however, to witness the effects of massage in cases where, from the presence of a considerable effusion, pressure effects are most marked, the rapidity with which the evidence of degenerative changes disappear, and the normal degree of activity of function becomes re-established is surprising.

It would be quite beyond the writer's object to enter here into any exhaustive account of the effects of massage upon the lymphatic system, and the circulation of lymph; those who desire to gain a further insight into this most interesting question are

referred to the work of Dr. Stretch Dowse, to which reference has already been made; suffice it to say, that passive muscular movements such as those produced by the massage processes *are all important factors in promoting the re-absorption and removal of abnormal effusions*; here then we have at once the means by which we can attain the primary object which we have in view, namely, the promotion of the re-absorption of the effused lymph, which plays such an important part in bringing about the pathological changes which have taken place, and which, by the actual pressure that it exerts upon the already badly nourished nerve fibres, is one of the chief factors in the nerve dis-organization which ultimately occurs. When we are able to bring into operation upon the diseased spot an agent which exerts an influence both locally and upon distant parts of such importance in its character and bearing upon the constitutional condition of our patient,—more important than we are yet able to comprehend,—it becomes evident that under such an influence we are able at once to place our patient fairly on the road towards recovery. I wish it to be clearly understood,

however, that when I speak of massage, I mean something more than the manipulations of the unskilled medical rubber; by massage, I mean the scientific and skilled manipulations of operators who thoroughly understand what they are doing, and who possess a fine sense of appreciation of the important molecular nutritional and structural changes which they are setting into active operation. Massage unskillfully applied had much better be left alone, whereas a proper and scientific application of this important agent is of the utmost value both to practitioner and patient.

Having placed our patient under a course of massage as above indicated, we soon discover that evidences of the existence of pressure and irritation of nerve fibres becomes less marked, while functional activity shows signs of return to a normal standard. At this point in the management of the case the application of electricity will be found to be of the greatest service. As the result of personal experience, I do not advocate the use of electricity too early in old standing cases, the ultimate results will be much more satisfactory if the patient is first placed under

conditions of perfect rest, accompanied or followed, according to circumstances, by a thorough course of massage, which should not be confined in its application to the painful part; the whole of the affected limb from the toes upwards, and the whole length of the spine should receive a share of our attention. It is only when treatment carried out on the lines suggested here has been in operation for some time, and evidences of a return to the normal standard of nutrition, as manifested by a decrease in pain, are becoming evident, that galvanism or faradism will be of any service. We must recollect, however, when we come to apply such a powerful agent as electricity to the diseased limb, that not only have important functional defects been in existence for some considerable time, but also that these are merely the outward manifestations of undoubted structural derangements, which are at the same time taking place within the nerve tract itself, and hence the necessity for the utmost caution in our application of the electric current, lest we should by over stimulation utterly abolish the already enfeebled conducting power of the diseased fibres; so that if

used early, especially in the treatment of old standing cases, electricity should be employed with great care, and the results of its application closely watched. The use of the induced current is not in my opinion admissible at first, for we must ever remember that the extreme instability of the nerve which is usually present in these cases, is but an evidence of greatly enfeebled conductive power; for this reason it will be found advisable at the outset to employ a weak galvanic current, applying the positive pole to the painful part, or else, with slow alternatives for a period of from twenty minutes to half an hour. Such an application followed by a gentle masseeing of the whole limb is extremely comforting. I have witnessed patients come in in pain and go away in comparative comfort, having experienced considerable and speedy relief as the result of such an application. The following extract from my case book will illustrate my meaning :—

W.R.M., æt. 79. Acute neuritis of the left sciatic. This was a case in which the pain was of the most excruciating character, affecting the whole limb, even to the toes, coming on worse at night. Treatment was commenced on July

14th. The following are extracts from my notes. July 20th.—Pain relieved somewhat; his nights have been better since he has been under treatment. July 22nd.—Feeling much better; has less pain night and day. July 29th.—Pain in the thigh and calf much better; the chief seat of pain is now the front of the tibia along its lower third (this was the site of an old gun-shot wound), the dorsum of the foot and around the ankle. Aug. 1st, 3rd and 10th.—The improvement steadily continues, the limb gaining in strength. On the latter date for the first time he walked step over step. About a week after this treatment was discontinued he went away to Weston-super-Mare, being quite free from all pain. In this case it was remarkable how each application gave almost instantaneous relief to the patient's sufferings.

But the treatment here indicated should never be allowed to supersede the employment of appropriate remedies, such as the sulphate of quinine, either alone or in combination with gelsemium, or Fowler's solution, or in certain cases the iodide of potash will be found of the greatest service. I have also known patients experience great relief by the administration of a nightly draught, consisting of seven grains

of antipyrin in combination with fifteen or twenty grains of bromide of ammonium. Massage and galvanism, far from being intended to replace such remedies as these, should rather only be used as an adjunct to them, seeing that it is capable of bringing about certain tissue changes, which it is not within the scope of the action of drugs to accomplish.

So much for the adoption of massage as a therapeutic agent for bringing about the removal of the effused lymph. We shall now turn our attention to the consideration of the manner in which a normal standard of blood supply to the part may be produced, the oxidation and respiration of tissue restored, and the lost balance of metabolism re-adjusted. Here again we find that the effects which may be brought about, and which it is the peculiar property of the massage processes to originate, are of the greatest assistance.

The effect of the massage movements upon the vaso-motor and vaso-dilator nerve endings is more than a matter of mere speculation, and is a study which is full of interest. The relation existing between the vaso-motor and

vaso-dilator nerves of the body, and the process of oxidation and respiration of tissue is so close and intimate, that we cannot find a disturbance of the one without a corresponding departure from the normal in the other also. What is known as the *thermogenic tonus* or normal standard and equilibrium of heat production and heat discharge, is under the direct control of the vaso-motor and vaso-dilator nervous system. Given a disturbance of the functional activity of these nerves, and you have a corresponding disturbance of the finely adjusted balance existing between the oxidation and respiration of the tissues involved; the former is not carried out so as to promote the healthy performance of function, neither does the removal of the effete material take place as it ought, the result of such a disturbance between the food supply and the removal of waste products being an interference with the process of tissue nutrition, and an impairment of function. One of the first effects of massage is the elevation of the surface temperature by several degrees, owing to the fact that massage stimulates the vaso-motor and vaso-inhibitory nerve endings, thus an increased and more active blood

supply is conveyed to the part acted upon, and an increase in the processes of oxidation and respiration of tissue results; this is one of the most important changes which it is desirable to bring about. Long standing mischief in the great nerve trunk of the limb is invariably accompanied by changes in the adjacent muscular structures, which are degenerative in character, and which are of the greatest clinical significance as indicating defective nutrition of the part: this condition has an invariable tendency to go from bad to worse. It is only necessary to grasp the limb which has been the seat of degenerative changes of this character to become conscious of the fact; the muscular structures are soft and flabby in the hand, muscular tone is as a rule wanting, and electric excitability is either lost or abnormally increased, while the limb may have decreased in girth measure to the extent of one inch or more below that of the unaffected side. It is remarkable how under the influence of massage as by no other means this condition rapidly improves, the muscular tissues become firm and hard, the limb steadily increases in size until it equals that which is unaffected. The following are the notes of a

case in which a limb which was the seat of a neuritis, and measured one inch in girth less than its fellow, increased steadily under the influence of massage at the rate of from a third to a quarter of an inch a week, until it equalled the sound limb.

W.Y., æt. 32; iron-moulder. Neuritis of the left sciatic nerve, of eight months' duration, during which time he had been continually under treatment, without obtaining any relief. At the time this note was taken, Feb., 1892, he was obliged to give up work, and was confined to his bed; could get no sleep owing to the pain. He came under treatment on Feb. 2nd, his sciatic nerve was in a most irritable condition, as shown by electrical reactions. On Feb. 12th he expressed himself as being better than he had been for months. By this time the electrical reactions were becoming more normal; he resumed work on Feb. 15th, but continued under treatment until Feb. 26th, at which time he was quite free from pain, and has continued so since. In this case the affected limb measured one inch less than the other side when he came under treatment, but by the time he left off it was equal to the sound limb.

When the functional activity of a part is being in measure restored, the application of electricity appears to be of the greatest service. The galvanic current may now be replaced by the faradic, the anode being applied over any remaining painful parts. The writer has found the faradic current applied by the labile method to be most beneficial in restoring the muscles to a healthy condition; at any rate, as the treatment proceeds electro tonus *assumes more nearly a normal standard*, pain diminishes, functional activity is restored, and what was once an exceedingly painful and helpless limb, now assumes a condition of comparative comfort and ease.

In conclusion, I would urge the fact of the nature of the therapeutic action of the massage processes, to restore the lost balance between oxidation and respiration of tissue, as an all powerful reason for its adoption in those cases where the vital processes are at a low ebb, and where nerve function is imperfectly performed as the result of defective nutrition, feeling assured that in it we possess a therapeutic agent which exceeds the power of any known drug in bringing about changes

which are of such vital importance, and while it is not intended to supersede appropriate medicinal treatment, its proper and scientific application will be found to be a most powerful adjunct in setting into action those processes which are so important for the maintenance of normal functional activity in the diseased nerve structure.

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